

## **The Challenge of Information Service Development for Private Forest Owners: The Estonia and Finland Cases**

Ritva Toivonen, Erno Järvinen, Karoliina Lindroos  
and Anna-Kaisa Rämö  
Pellervo Economic Research Institute PTT  
Eerikinkatu 28 A  
00180 Helsinki, Finland

Pekka Ripatti  
TTS Institute  
Melkonkatu 16 A, P.O. Box 28  
00211 Helsinki, Finland

This paper investigates forest ownership objectives and the need for information among Estonian and Finnish private forest owners based on two surveys. The motivation for the analysis is the fragmenting private forest ownership in Europe. The broad lines of ownership objectives are found to be similar in both countries, and can be described under the dimensions of economic objectives, intangible values, and products and activities provided by forests. In both countries, economic and intangible objectives are considered important at the same time. Thus forest owners can be described as multi-objective. The economic objectives are ranked as somewhat more important than non-economic objectives in Estonia, but not in Finland. Estonian forest owners most strongly emphasise information about legal and economic matters, including forest taxation and forest health issues, while Finnish forest owners emphasise information about wood markets and forest taxation. Differences between the two countries may be related to private ownership being relatively new in Estonia. Some generalisations may be drawn for European forest policy. Overall, private forest owners need both information about economic issues and personal advice on how to manage forests with regard to their individual and multiple objectives. Generally, personal advice may be concentrated on the complicated and most important themes, while information can mostly be provided via written or electronic channels. Particularly in countries where private forestry is new, there is a need for personal advice on legislative and economic matters. As a conclusion, it is suggested that efficient allocation of resources and development of information services require regular analysis of private forest ownership, and segmenting private forest owners according to their objectives and information needs.

**Keywords:** private forest ownership, ownership objectives, forest policy, factor analysis

## INTRODUCTION

Non-industrial private forest ownership dominates in Western Europe, while in Eastern Europe most forest land is still publicly owned. It has been estimated that there are about 7 M private forest holdings in the former European Union 15 area (EU-15), and these holdings are owned by about 12 M private persons (e.g. Hyttinen 2000). Ten Central and Eastern European countries joined the EU in May 2004, which also made the forestry sector in the Union markedly larger. In the new EU states the continuing land restitution process will result in about 3 M new private small forest holdings, and thus the total number of holdings in the EU-25 will be 9-10 M at the end of this decade, with 15-16 M private forest owners (Toivonen and Mäki 1999, ECOSOC 2002, Finnish Forest Research Institute 2004).

The tendency in forest ownership in Europe is towards further fragmentation of holdings and increasing heterogeneity (Hyttinen 2004). The land restitution process in Central and Eastern Europe is a source of major structural and institutional change in land ownership in the whole of Europe. Private ownership was almost non-existent in Central and Eastern Europe between the 1940s and early 1990s. The new private forest holdings are mostly small, about 2-3 ha (Toivonen and Mäki 1999, ECOSOC 2002). Small holdings are not necessarily interesting from an economic point of view, which may reduce the interest in investment in forest management. The forest owners rarely have experience or inherited connections to forestry. Motivations for forest ownership are not yet well known.

Private forest ownership and ownership objectives are also changing in the EU-15 region, though much slower than the dramatic development in the new member countries. In the EU-15 region, the aging and urbanisation of the owners is continuing. Forest holdings also tend to be divided into smaller lots through inheritance. Owners are increasingly less dependent on forest-related incomes. Private forest owners are aging as the whole population ages, but the average age of forest owners is higher than the population average (Ripatti 1996).

Income from timber sales is one objective for forest ownership (e.g. Karppinen *et al.* 2002); for example, forest owners finance investments using forest income (Brazee *et al.* 2003). However, research has shown that non-industrial private forest owners generally have multiple objectives for their forest ownership (Marty *et al.* 1988, Kuuluvainen and Ovaskainen 1994, Kuuluvainen *et al.* 1996, Karppinen 2000, Karppinen *et al.* 2002). At least the following ownership objectives or orientations have been revealed: economic/market, forest management, investment, multiple use, self employment, amenity values and conservation orientations.

Evidence from Finland indicates that amenity targets are becoming increasingly common among forest owners (Karppinen *et al.* 2002), while the proportion of owners who are economically dependent on their forests is decreasing along with the diminishing number of farmers (Hyttinen 2000, 2004, Karppinen *et al.* 2002). However, the change has not, at least yet, resulted in a clear reduction in the wood supply, although the patterns of selling wood have changed (Ovaskainen and Kuuluvainen 1994, Karppinen *et al.* 2002). This may increase supply fluctuations on wood markets. Recent econometric analyses suggest that wood supply may have become more price elastic than earlier (Mutanen and Toppinen 2004).

If non-economic values become more important and common goals than incomes from forests, this may in the long run lead to reduced investments in forestry and

eventually to reduced harvests (Järveläinen and Torvelainen 1993). One reason for a reduced interest might be the declining role of forest incomes in comparison to wage incomes (e.g. Ovaskainen and Kuuluvainen 1994).

In summary, changing forest ownership structure may result in a reduced wood supply, but not necessarily. A reduced supply of wood and investment in forest management would erode the competitiveness of European forestry. The impacts would be amplified in the forestry wood chain and in rural economies, since forestry contributes substantially to the overall economy in rural areas in several parts of Europe (Hyttinen 2000). Wood supply can be positively affected by forest policy measures, such as financial incentives and information and training, even though the relationship is not straightforward or easy to measure precisely (Ovaskainen and Kuuluvainen 1994, Leppänen *et al.* 2001, Linden and Leppänen 2003).

### **Information and Training in Focus**

There is high diversity in the nature of forests and their importance and functions in European countries, which may be demonstrated by the fact that the forest area per capita varies from 0.02 ha to about 4 ha in European countries. Therefore, the EU does not pursue a strong or comprehensive common forest policy; rather, forest policy is mainly the mandate of each member country (Ottitsch *et al.* 2002). The general objective is that forestry should be multifunctional and sustainable in ecological, economic and social terms (EU 1998). The forest sector and wood markets should be based on the rules of a free market economy and free competition, both on the EU level and in individual member countries. However, forests are seen as one component of rural development and are included in policies related to the rural economy. In addition, forests are considered in environmental and energy policies, including climate issues (ECOSOC 2002, Hyttinen 2000 and 2004, Teeter *et al.* 2003). Nevertheless, forest policy is both outlined and implemented mainly on a national level in the EU, and the goals and instruments differ from country to country, depending on the particular characteristics, traditions and importance of forestry (Grayson 1993, Hyttinen 2000, Ottitsch *et al.* 2002).

Generally, forest policy may be supported with three types of instruments: regulatory (legislation and regulations, which are obligatory), fiscal (subsidies, taxation, which may be obligatory and voluntary), and indirect or information-based instruments (e.g. campaigns, information and training, education and research, which are voluntary) (Ottitsch *et al.* 2002, Solberg 2003). The focus of this paper is on information and training.

Information and training are suitable to support various types of policies, and are also in line with the competitive market approach to forestry adopted on the EU level. Most Western European countries have traditionally counted on these as important measures in private forest policy (Grayson 1993). Nevertheless, there are considerable differences in the overall packages of forest policy measures and incentive programs between European countries (Ottitsch *et al.* 2002), and also more globally between OECD and East European and East Asian countries (Solberg 2003).

It is difficult to assess precisely the effectiveness of forest policy measures, including information and training (Boyd 1984, Grayson 1993, Hänninen 1994, Leppänen *et al.* 2001, Ottitsch *et al.* 2002, Solberg 2003). Thus, there is continuing debate about the pros and cons of alternative policy instruments (e.g. Ziegenspeck

2002), and a need for research evaluating the impacts and effectiveness of the various policy instruments (Solberg 2003).

Solberg (2003) concluded that information and training have long term impacts but may provide important support for forest policy targets. There is also research evidence of a link between information or extension and private forest owner activity (e.g. Karppinen *et al.* 2002). It can be assumed that information and training are currently becoming increasingly important as instruments to activate forest owners to manage their forests themselves. The reason is that the general tendency is towards lower rather than higher levels of public financial support for forestry (Ottitsch *et al.* 2002, Hyttinen 2004).

Applying policy instruments usually relies on the assumption that forest owners are a homogenous group (Blum and Schanz 2002). Therefore private forest owners being an increasingly heterogeneous group, presents a growing challenge in the targeting of scarce resources and systems available for training and extension as efficiently as possible. One problem is the lack of information about private ownership in general and particularly in the 10 new EU countries, as well as a lack of knowledge regarding the current information and training needs of private forest owners.

This paper aims to analyse private forest owners' objectives in forest ownership, and their information needs in Finland and Estonia. Earlier research provides a basis to hypothesize that there is a connection between the structural and demographic characteristics of forest ownership, forest ownership objectives, and behaviour (Greene and Blatner 1986, Dennis 1989, Ihalainen 1990, Cleaves and Bennett 1994, Ovaskainen and Kuuluvainen 1994, Hänninen *et al.* 2001, Karppinen *et al.* 2002). Therefore, the structural and demographic characteristics of forest ownership are also examined in this paper. However, the behaviour of owners is not considered, nor the connections between objectives and information needs.

The two countries provide interesting cases for comparison. They are relatively similar in type of forests and forestry, even though Estonia is considerably smaller than Finland, and they are among the most forested member states in the EU-25. Softwood species dominate the growing stock, and the forest ownership structure has developed towards increasing similarity. Forestry is important in both countries from economic, social and ecological perspectives. However, Estonia is a new EU member country with newly-established private forest ownership, while Finland has a long tradition of private forestry.

The next section of this paper provides an overview of forestry and the forest ownership structures in Estonia and Finland, and compares this with the overall forest ownership structure in the EU-25. The following section reports the data and methods used in the two empirical forest owner surveys, which form the basis for describing the situation in Estonia and Finland. Empirical results of forest ownership objectives and information needs among private forest owners in Estonia and in Finland are then presented. Discussion and conclusions sections follow.

## **FORESTS AND FOREST OWNERSHIP IN THE EUROPEAN UNION, ESTONIA AND FINLAND**

The forests in the European Union (EU-25) cover about 140 M ha (Finnish Forest Research Institute 2004). The growing stock is about 15 billion m<sup>3</sup>, of which over 13 billion m<sup>3</sup> is in forests available for commercial utilisation. Ten new countries joined the Union in 2004, which increased the forest area of the EU by about a fifth, and the growing stock by almost 40%. There are about 0.3 ha of forest for each of the 450 M EU citizens. The forest area has changed little in the EU-15 region during recent decades. However, the forest cover clearly increased in several of the 10 new member countries between the 1940s and 1980s.

Forests in the European Union are mainly privately owned. Currently 51% of commercial forests are privately owned (58% in the EU-15 and 21% in the 10 new member countries) (Finnish Forest Research Institute 2004). The proportion of privately-owned forests in the new member countries is expected to increase to about 30% to 40% during the next few years (ECOSOC 2002). The number of privately-owned holdings varies according to the definition used, and there is no uniform definition for private forest holding<sup>1</sup>.

Bulgaria and Romania are expected to join the EU in 2007. In the EU-27, the share of privately-owned forests is likely to be 54 to 55% when the land restitution process in the new member countries is finalised, bringing the total area of forests available for economic use to about 126 M ha and the number of privately-owned holdings to about 10-11 M.

According to Statistics Estonia (2001), the forest area in Estonia is about 2.3 M ha (52% of the land area), which is clearly more than the FAO statistics shown in Table 1. The growing stock is also larger, at 411 M m<sup>3</sup>. Nevertheless, the magnitude of forestry according to national and FAO statistics is similar. The number of privately-owned forest holdings was about 52,000 in 2001 (Centre of Forest Protection and Silviculture 2001b), but is expected to approximately double when the restitution and privatisation process is finalised (Table 1). The average size of private forest estates is about 10 ha.

The Estonian forest industry started to grow rapidly in the mid-1990s, and the industrial capacity has already grown to an extent where the exploitation of domestic wood resources exceeds the annual increment (Tilli and Skutin 2004). Therefore, Estonia is turning from a net sawlog exporter to a net importer. Wood prices have increased continuously in Estonia since the mid-1990s due to the growing demand for roundwood (Toppinen *et al.* 2005).

Finland has approximately 22 M ha of forest land covering 72% of the land surface. About 62% of the forest area is privately owned. Private forests are fragmented into about 450,000 holdings of at least 1 ha in size. The average size of these holdings is approximately 30 ha. About 80-85% of the net annual increment is harvested annually. Harvests and industrial production grew continuously until the late 1990s. Forest industry production has increased slightly during early 2000s, but the annual harvests of industrial roundwood have stagnated to a level of about 55 M. The price of roundwood has been relatively stable during the first half of 2000s. Finland has been a net importer of roundwood for decades. Imports have

---

<sup>1</sup> For definitions of small scale private forestry, see for example Hyttinen (2000, 2004).

continuously increased, particularly since the early 1990s, and the growth of forest industry production has been based on imported wood during the 2000s. The main source of roundwood imports is Russia (Finnish Forest Research Institute 2004).

**Table 1.** Forests and forest ownership in the European Union, excluding Malta and Cyprus

Country	Land area	Population	Forest area	Forest cover relative to land area	Fraction of forest area in economic use	Growing stock	Current / future expected private ownership <sup>a</sup>	Current / future expected approx. number of holdings <sup>b</sup>	Harvest (2002)
	M ha	M	M ha	%	%	Billion m <sup>3</sup>	%	1000s	M m <sup>3</sup>
Netherlands	3.4	15.7	0.4	11	84	0.052	21	<5	0.8
Belgium	3.0	10.2	0.6	21	99	0.140	55	105	4.5
UK	24.2	59.0	2.8	12	75	0.293	38	100	7.4
Spain	49.9	39.6	14.4	29	73	0.487	76	680	15.8
Ireland	6.9	3.7	0.7	10	88	0.043	34	30	2.6
Italy	29.4	57.3	10.0	34	60	0.877	65	820	7.5
Austria	8.3	8.2	3.9	47	86	1.037	69	214	14.8
Greece	12.9	10.6	3.6	28	86	0.140	17	<5	1.6
Luxemburg	0.3	0.4	0.09	33	100	0.020	53	10	0.1
Portugal	9.2	9.9	3.7	40	52	0.188	79	380	8.7
France	55.0	58.9	15.3	28	94	2.836	61	3800	35.4
Sweden	41.2	8.9	27.1	66	78	2.567	51	250	66.8
Germany	34.9	82.2	10.7	31	94	2.820	47	450	42.4
Finland	30.5	5.2	21.9	72	94	1.867	63	450	53.0
Denmark	4.2	5.3	0.5	11	97	0.054	45	20	1.4
Estonia	4.3	1.4	2.060	47	94	0.307	63	52/100	10.2
Latvia	6.2	2.4	2.923	45	83	0.409	45/50	153/250	13.5
Lithuania	6.3	3.7	1.994	32	85	0.314	17/50	120/152	6.1
Poland	30.4	38.7	9.047	28	92	1.930	18	1400	27.1
Hungary	9.2	10.1	1.840	20	92	0.295	4/45	290/335	5.8
Czech R.	7.7	10.3	2.632	34	97	0.668	16/24	137	14.5
Slovak R.	4.8	5.4	2.177	45	78	0.446	18/48	300	5.8
Slovenia	2.0	2.0	1.107	55	93	0.292	70	300	2.3
Total	385	450	140	36	117	84	51	9/10 M	349

a. Private ownership includes non-industrial and industrial private ownership and the definition of a forestry holding varies from country to country according to the size of the holding.

b. Estimates for the last eight countries are for the current time and after restitution.

Source: Finnish Forest Research Institute (2004), information based on FAO statistics. Numbers of forest holdings in various countries obtained from Grayson (1993), European Commission (1998), Toivonen and Mäki (1999), Hyttinen (2000) and ECOSOC (2002).

## RESEARCH METHOD

Data were collected in two mail surveys, in Estonia in 2001 and in Finland in 2003. The questions about forest ownership objectives and information needs were formulated based on earlier research carried out in Finland (e.g. Karppinen *et al.* 2002) and in Estonia (Karppinen 1996) as well as thematic expert interviews. Similar data collection procedures were followed in both countries. The questionnaires were tested by interviewing forest owners. In Finland, a test mailing (50 forest owners) was also conducted before the full mailing. In Estonia, the questionnaire was translated to Estonian, and then 17 forest owners were test interviewed by an Estonian interviewer. Following test interviews and expert opinions, the questionnaires were adjusted to the circumstances of each country. This resulted in some differences between the attributes and variable sets used for Finland and Estonia<sup>2</sup>. In both countries, the first mailing was followed by a reminder letter and a new questionnaire. In Finland, a reminder card was also sent.

The target population in Estonia consisted of all forest owners – 51,777 as on 1 January 2001 – obtained from the Centre of Forest Protection and Silviculture (2001b). The original sampling frame for the study (844 forest owners) comprised the forest owners included in the address registers of Erametsakeskus (Centre of Private Forestry) and Eesti Erametsaliit (Estonian Private Forest Union). The list was considered to represent forest owners who are at least to some degree familiar with forestry, which is necessary for valid survey results. However, since the sample was not a random selection from all Estonian forest owners, the reliability of the data was checked by comparing the background variables and results with an earlier study of Karppinen (1996), and with a study carried out in the same year by the Centre of Forest Protection and Silviculture and Ministry of the Environment of Estonia (2001b). Altogether, 584 Estonian forest owners returned questionnaires by the final deadline, a response rate of 72%. Of the 260 forest owners who did not return the completed questionnaire, 28 advised that they were not suitable to participate in the survey and seven persons were not reached.

In Finland, the target population consisted of all Finnish forest owners who were listed in a register held by the landowners' union (MTK), i.e. 259,044 forest owners with holdings of at least 5 ha. Very large holdings are excluded from the register, but this was not expected to bias results greatly due their small number (2400). Two thousand forest owners were selected randomly, of which 50 were used to test the questionnaire, after which questionnaires were sent to the remaining 1950 owners. Forty three forest owners were not reached and 26 recipients were no longer forest owners, which made the effective population size 1881. Altogether, 880 acceptable responses were returned by the date deadline, a response rate of 47%.

The data from both surveys were analysed in terms of frequency distributions, means and significance tests between respondent groups. Differences between respondent groups were also examined using cross-tabulations and  $\chi^2$  tests. Factor analysis (Principal axis factoring) with Varimax rotation was applied in studying the

---

<sup>2</sup> The original main objective of the two surveys was not to compare the situations in Estonia and Finland, but to analyse the situation separately in each country. The study in Finland was initiated later than the study in Estonia, and focused more strongly on wood sales than the study in Estonia, where the main focus was on information needs.

latent dimensions of objectives (following Afifi and Clark 1990 and Hair *et al.* 1995). Only those cases that had no missing values for any of the variables were included in the analysis. Cronbach's alpha coefficient was used to assess the consistency of the scales revealed by factor analysis. The data were analysed using SPSS software.

## FOREST OWNERSHIP OBJECTIVES AND INFORMATION NEEDS IN ESTONIA

### Structure of Estonian Private Forest Ownership

Comparison of survey responses with those of the Centre of Forest Protection and Silviculture and Ministry of the Environment of Estonia (2001b) indicated that the sample was satisfactorily representative of the population of Estonian forest owners regarding the majority of background characteristics. The average age of Estonian forest owners in this study was 52 years. Almost two thirds of Estonian private forest owners are over 50 years old, the average age being 55 years (Centre of Forest Protection and Silviculture and Ministry of the Environment of Estonia 2001b). The average length of forest ownership was found to be approximately 4 years. Most forest owners were found to live less than 5 km from their forest estates<sup>3</sup>. Thus, Estonian forest owners typically live in rural surroundings. Only about 12% were members of a forest owners' organisation.

Some differences in background characteristics were detected between the sample in this study and the reference study of the Centre of Forest Protection and Silviculture and Ministry of the Environment of Estonia (2001b). The average size of the forest estates in this study was larger than generally in Estonia (35 ha versus 10.5 ha), and the proportion of female respondents was smaller than in the other study (24% versus 39%). However, the proportion of female respondents in this study was almost the same as in that found by Karppinen (1996). Forest owners in this study had a higher level of education than Estonian forest owners overall. One-third of Estonian forest owners have completed comprehensive school education and 18% have a university degree (Centre of Forest Protection and Silviculture 2001a); in this study the respective proportions were 12% and 34%. In addition, 12% of respondents in this study were farmers (12%) whereas the reference study excluded farmers. By contrast, the proportion of pensioners was lower in this study (20%) than in the reference study (39%).

Overall, it seems clear that the sample of this study includes forest owners who are on average better educated and whose holdings are larger than the average in Estonia. Most other forestry-related characteristics seem to be representative of an average forest owner in Estonia, including the age of forest owners, their place of residence and its distance from the forest holding.

---

<sup>3</sup> Centre of Forest Protection and Silviculture and Ministry of the Environment of Estonia (2001b). The data for this study were collected using the systematic sampling procedure among all forest owners (51,777). The sample was 1,600 forest owners, and 1088 responses were received (68%).

### Objectives for Forest Ownership

Forest ownership objectives were identified by asking owners to rate the importance of 10 alternatives, covering economic, ecological and social objectives (Table 2). Economic objectives (forest provides household timber and economic security) were the most important for forest ownership. The conservation of forest nature and landscape was also considered clearly important. Economic security provided by forest ownership was emphasised more than the generation of income from timber sales, possibly related to the fact that by the year 2001 only half of forest owners had ever sold timber on an open market. The proportion of respondents selling roundwood has increased over the years. The forest owners with a greater forest area ( $>20$  ha) had sold timber more often than the owners of smaller forest estates.

The individual objectives were studied using factor analysis, in which each potential solution from one to four factor solutions was tested (Table 3). The three-factor solution was found to be superior, both technically and from an interpretation point of view. The factors were interpreted to reflect latent dimensions of ownership objectives, namely economic objectives (Factor I), non-economic values and recreational objectives (Factor II), and (household) products provided by forests (Factor III). The dimensions were similar to those resulting from the Finnish study (reported in Table 5), even though there were fewer variables in the Estonian survey. However, there were some weaknesses in the solution, which explained only 42% of the total variation of the original variables. Cronbach's alpha for Factor III (household timber/other products provided by forests) in particular was low, indicating the low stability of the scale. Both issues indicate that there may exist forest ownership objectives that are not included in the limited set of items applied in this study. Thus, the measurement instrument should be further developed. However, the Kaiser-Meyer-Olkin statistic for sampling adequacy (0.766) and Bartlett's test of sphericity ( $p = 0.000$ ) suggest that factor analysis is a suitable method for analysing the variable set.

**Table 2.** Objectives for forest ownership in Estonia

Objective	Very Important					Mean	
	Not at all Important						
	1	2	3	4	5		
Fraction of forest owners (%)							
Forest provides household timber (firewood and construction timber)	40	40	14	4	2	1.9	
Obtaining economic security	33	37	24	5	2	2.1	
Conservation of forest nature and landscape	22	40	27	6	3	2.3	
Emotional and traditional values of forest ownership	19	35	28	11	8	2.6	
Offers job opportunities	15	29	35	15	6	2.7	
Recreational use	11	29	36	16	8	2.8	
Acquisition of income by selling timber	12	27	36	16	9	2.9	
Investment opportunity	9	32	30	18	11	2.9	
Secondary forest products (berries, mushrooms, game)	9	25	36	20	10	3.0	
Pasturage	3	7	10	26	55	4.2	

**Table 3.** Factor analysis of forest ownership related objectives (principal axis solution) with Varimax rotation<sup>a</sup>

Variable	Factor I: Economy	Factor II: Recreation/ Non-economic values	Factor III: (Household) Products
Job opportunities	0.843	*	*
Incomes from timber sales	0.833	*	*
Economic security	0.620	*	*
Investment opportunity	0.528	*	*
Recreation	0.565		
Emotional and traditional values of forest ownership	*	0.496	*
Conservation of forest nature and landscape	*	0.487	0.349
Pasturage	*	*	0.525
Secondary forest products (berries, mushrooms, game)	*	0.437	0.459
Supply of household timber	0.296	*	0.429
Eigenvalue	2.184	1.076	0.913
% of total variation (41.7%)	21.8	10.7	9.13
Alpha value	0.805	0.617	0.527

a. Loadings under +/-0.2 are suppressed and marked with an asterisk.

### Information Needs among Estonian Forest Owners

Information needs were studied using a pre-defined list of specified information and training issues. Information needs with regard to each item were ranked according to importance using a Likert scale from one to five (Table 4). The most important (or very much needed) information relates to legal matters, forest disease and pest control and economic issues.

Information needs were further studied using factor analysis. The analysis revealed that the information and training needs can be segmented into broader issues described as 'working practices', 'quality requirements and measurement of timber', 'forest management and forest diseases', 'legal and economic matters', and 'markets, wood trade and co-operation between forest owners, and environmental issues' (the statistics are reported in Järvinen *et al.* 2003).

The differences between forest owner groups regarding information and training needs were studied by first calculating the mean factor scores, and the means were compared using ANOVA. Forest owners who had an academic or forestry education had a lower than average need for information about market issues and working practices. In contrast, persons who had a low general level education had an above-average interest in information about forest management issues. The period of forest ownership, the size of the holding and the distance between the place of residence and the holding were also related to information needs. Those owners who had relatively large holdings or lived more than 5 km away from their forests needed more information about forest management than other forest owners. Owners who had received the holding after the year 1996 needed more often information about forest management issues than those who had already been forest owners in 1996.

**Table 4.** Information needs concerning forestry issues among Estonian forests owners

Forest related issue	Very much					Mean
	1	2	3	4	5	
	Fraction of forest owners (%)					
Legal matters (e.g. procuring logging permission)	48	32	13	5	2	1.8
Forest diseases and pest control	50	31	14	4	2	1.8
Economic matters (e.g. investment options, taxation)	45	32	16	4	2	1.9
Quality requirements of timber	36	35	19	7	3	2.1
Forest management	36	29	20	9	7	2.2
Co-operation between forest owners	30	35	26	7	3	2.2
Regeneration (tree species selection, soil cultivation)	30	35	21	7	7	2.3
Environmental issues (incl. certification)	26	34	28	8	4	2.3
Roundwood markets: prices and timber buyers	33	24	25	12	6	2.4
Measurement of timber	21	29	27	16	8	2.6
Site planning (e.g. forwarding roads, ditching)	21	23	30	15	11	2.7
Methods and standards in wood trade	19	27	29	17	8	2.7
Efficient working methods	15	26	34	17	9	2.8
Use of safety equipment	18	18	37	19	8	2.8
Planning cuttings and thinnings (e.g. tree selection)	22	22	20	19	17	2.9
Forest industry markets	13	23	36	20	9	2.9
Service of working equipment	12	23	33	20	13	3.0
Safe working practices	11	17	37	24	11	3.1

Estonian forest owners have most often used journals and periodicals in searching for information about forestry-related issues. Environmental non-governmental organisations, co-operatives of forest owners and associations of forest owners have been the least used information sources. In the future, over half of Estonian private forest owners would prefer printed and electronic media regarding most of the topics listed. However, regarding a few issues (legal and economic matters, forest disease and pest control, timber measurement, harvesting and site planning, forest management and regeneration issues), personal guidance or courses are most preferred<sup>4</sup>.

## FOREST OWNERSHIP OBJECTIVES AND INFORMATION NEEDS IN FINLAND

The forest owners in the Finnish survey were compared with the national population of forest owners. The structural change in agriculture in the last decade has reduced the proportion of farmers from 30% to below 20% of all private forest owners.

<sup>4</sup> Detailed results and statistics are reported in Järvinen *et al.* (2003).

However, the proportion of pensioners has increased. Less than half of the forest owners currently live on their forest holding. Urbanisation has not been rapid, even though the process is ongoing (Ovaskainen and Kuuluvainen 1994, Ripatti 1999, Karppinen 2000, Karppinen *et al.* 2002). Elderly forest owners typically move from their forest estates or farms to villages or small towns. Thus, Finnish forest owners still mostly live in rural areas, even though the direct linkage to farming has been reduced.

From the sample data, the average length of forest ownership was 23 years, the average age was 59 years, and 74% of owners were male. The level of education among forest owners was found to be relatively low. About 62% of owners had only a comprehensive school level basic education, 42% had no professional education and only 10% had an academic degree. About 43% of private forest owners were on a pension, 29% were wage earners, 19% were farmers and the remaining 9% included entrepreneurs, students and unemployed persons. About 60% of owners considered that they live in the countryside, and only 9% live in towns with over 100,000 inhabitants. The average size of the forest estate (including only estates of 5 ha or more) was larger than the average in Finland (44 ha versus 37 ha). Almost all Finnish forest owners are members of forest owners' associations by law. Overall, the sample data appear to represent Finnish forest owners well with regard to demographic background factors.

### **Objectives Related to Forest Ownership in Finland**

Objectives related to forest ownership have changed in Finland during the last 10 to 15 years, along with the structural change in private ownership and the overall economic and social development in the society. In earlier studies, forest owners have been classified into four groups based on their objectives. The groups can be broadly described as recreational users, income-oriented, economic security oriented, and multi-objective owners (Karppinen *et al.* 2002). During the 1990s the group of forest owners who consider forestry highly important for their economy diminished. By contrast, the group of multi-objective owners has increased, and about half of Finnish private forest owners currently belong to this group (Karppinen *et al.* 2002). While non-economic objectives have become more important, research has not, at least yet, indicated a clear linkage between this change and the wood supply (Ovaskainen and Kuuluvainen 1994, Kuuluvainen *et al.* 1996, Karppinen *et al.* 2002). Instead, it seems that multi-objective owners have been more active in wood sales than other owners (e.g. Ovaskainen and Kuuluvainen 1994). Despite this, the link may exist, but it has possibly been hidden by other developments affecting wood supply, such as a major change in forest taxation in Finland culminating in 2006<sup>5</sup>.

In this study, a similar set of 22 objectives was applied to that of Karppinen *et al.* (2002). Analysis of individual variables shows that the most important single objective for Finnish forest owners is to obtain household timber (Table 5), i.e. the same objective that Estonian forest owners ranked as the most important. The second most important objective is related to intangible values, such as the ownership value of forest land and the possibility to enjoy the peace of nature in

---

<sup>5</sup> Details of forest taxation changes and their impacts on private forestry and the short-term wood supply are provided by Rämö *et al.* (2005).

one's own forest. Work and recreational possibilities are also important. Economic and environmental objectives are ranked from moderate to fairly important, but neither is ranked among the most important objectives.

Analysis of the distribution of ranks of the variables (distributions not reported) reveals that several non-monetary values and objectives are important for most forest owners. However, there is greater variation regarding many of the economic (particularly investment-related) and work-related objectives, i.e. these objectives segment forest owners more clearly than the intangible or non-monetary objectives.

Latent dimensions of forest ownership objectives were studied using factor analysis. All alternative solutions from one to five factors were tested, the technically best solution being the three-factor solution. It is also easily interpretable. The solution was improved by deleting two variables with low communalities, the result being a three-factor solution including 20 items. Each factor has a sufficiently high scale reliability based on the Cronbach's alpha values. The solution explains 52% of the total variation of the variable set. The Kaiser-Meyer-Olkin test value for sampling adequacy (0.915) and Bartlett's test of sphericity ( $p = 0.000$ ) indicate that factor analysis is appropriate for the data set.

**Table 5.** Dimensions of Finnish forest ownership related objectives (Factor analysis, Principal axis solution with Varimax rotation)

Variable (average importance rank)*	Factor I: Economy	Factor II: Values and Recreation	Factor III: Activities and Products
Income while on pension (3.1)	<b>0.852</b>	*	*
Income from wood sales (3.2)	<b>0.840</b>	*	*
Finance for unexpected needs (3.5)	<b>0.774</b>	*	*
Large investments (2.9)	<b>0.726</b>	*	*
Continuous income from forests (2.9)	<b>0.723</b>	*	0.272
Hedge against inflation (3.5)	<b>0.701</b>	0.259	*
Investment target (2.9)	<b>0.636</b>	*	*
Work income (2.4)	<b>0.523</b>	*	0.447
Inheritance (3.6)	<b>0.486</b>	0.355	*
Visual pleasure (3.6)	*	<b>0.722</b>	0.321
Biodiversity conservation (3.5)	*	<b>0.666</b>	0.363
Place for relaxing/meditation (3.8)	*	<b>0.697</b>	0.354
Nature conservation (3.1)	*	<b>0.647</b>	0.261
Linkage to home region (3.5)	*	<b>0.563</b>	*
Ownership as such (3.9)	0.305	<b>0.540</b>	*
Recreation outdoors (3.7)	*	0.500	<b>0.556</b>
Picking berries (3.8)	*	0.380	<b>0.630</b>
Living surroundings (3.9)	*	0.462	<b>0.554</b>
Forest management work (3.9)	*	0.218	<b>0.523</b>
Household wood (4.0)	*	*	<b>0.497</b>
Eigenvalue	4.685	3.412	2.319
Explained variation (%)	23.426	17.092	11.594
Cronbach's alpha (standard)	0.904 (9 items)	0.849 (6 items)	0.802 (5 items)

Importance scale: 1= not important at all; 5 = very important. Loadings under 0.2 are suppressed and marked with an asterisk.

The first factor in the three-factor solution received high loadings on economy-related variables and is named 'Economy'. The second factor includes variables related to non-monetary or intangible values of forest ownership, including recreation and nature conservation, and is named 'Intangible values and recreation'. The third factor includes variables related to activities in forests and the role of forests in supplying products directly to the household (wood, berries, game), and is named 'Household products and activities'. The interpretation of the dimensions is similar to that in the Estonian survey.

### **Information Needs and Channels**

Respondents were asked about their information needs, under the set of headings listed in Table 6. However, few of the respondents actively named any other topic, even though this was requested. Most forest owners find information about wood markets important (would like to obtain information on the issue), and forest taxation is an almost equally important issue.

Cross-tabulations (not reported here) revealed some differences between male and female forest owners in their information needs: men were more often interested in wood price information than female owners. However, female forest owners needed information and advice on roundwood trade (methods and practices) more often than male forest owners. Owners with less education were more interested in obtaining information about wood sales. Urban forest owners needed advice and information on wood sales more than those living on or near their holdings. However, those who had owned their forest for 10 years or less were the more often interested in forestry information<sup>6</sup>.

**Table 6.** Issues for which Finnish forest owners would like to obtain more information or advice (in 2003, % of owners).

Issue for which information is needed	Fraction of respondents
Wood prices (on regional level)	61%
Forest taxation	55%
Transferring forest holding to the next generation	29%
Energy wood harvest/trade	32%
Wood sales (e.g. how to make a sales contract)	22%

Information needs were also related to forest holding size. Owners of very small and large holdings were less commonly interested in forest taxation than owners with holdings between 11-50 ha. Owners living in municipalities other than where their forests were located needed price information more often than owners living in the same municipalities as where their forest were.

About 63% of Finnish forest owners said they would prefer to obtain forestry-related information in printed form. Over one-third would also or only like personal advice (37%), and as many would like to have information through professional magazines (37%) or daily newspapers (35%). While 25% of owners would prefer short forestry-related events (for example one evening or day), particular extension

---

<sup>6</sup> Further details are presented in Lindroos (2005).

services (such as courses) were preferred by 18% of owners. The Internet is preferred by 23% of respondents, 16% of owners would choose television, and 15% literature. The radio as a source of forestry-related information is preferred only by 7% of forest owners. The Internet seems to be growing in popularity as a channel for forestry-related information. This result is somewhat different from an earlier study (Hänninen and Uusipuro 2002), which indicated that personal advice would be the information form most preferred, followed by printed information. Nevertheless, both studies demonstrate that printed information and personal advice are the two most important means of informing private forest owners in Finland.

## SUMMARY AND DISCUSSION

A need for information services for private forest owners in Europe arises from the major institutional changes, namely the re-establishment of private forest ownership in Central and Eastern European countries and the overall but slow fragmenting and increasing heterogeneity of private forest ownership in other parts of Europe.

The smaller the holding, the smaller is its absolute economic value. Thus, if holdings become smaller, they may also become economically less interesting to their owners. In particular, the economic value of small forest holdings may decrease in regions that are located far away from urbanised areas where the demand for real estate may increase land prices.

Urbanisation, aging and particularly the decreasing dependency on forestry incomes among forest owners, together with diminishing cultural bindings to rural regions, may reduce the interest in investing in forest management. In the long term, this may reduce the supply of wood. There may be impacts on the landscape, environmental sustainability and recreational possibilities provided by forests. These developments would have impacts on the forest industry and the rural livelihood in Europe.

A comparison of Estonian and Finnish forest owners indicates that forest ownership objectives can be described in both countries with three relatively similar dimensions: 1) economic objectives, 2) non-monetary values and recreational aspects (intangible values), and 3) supplies for the household and forestry-related activities. Not only the latent dimensions but also the importance of individual objectives was similar in Estonia and Finland.

Many forest owners find economic and intangible objectives important at the same time. Hence, forest owners may be quite generally described as multi-objective in both countries. Notably, non-monetary objectives are clearly important to forest owners in both countries. However, economic objectives are ranked relatively higher in Estonia than in Finland. Considering the different history of private forest ownership in the two countries, the objectives seem surprisingly similar, and may become more similar over time.

Differences between the two countries are also apparent with respect to information needs, even though one needs to consider that the sets of attributes presented in the two surveys were not identical regarding forest ownership objectives and particularly information needs. Thus, only imprecise comparisons and indicative conclusions can be made. In Estonia, forest owners consider economic and legal matters as well as forest health issues to be highly important. In Finland,

information is most often needed about wood markets and taxation. This situation may also develop towards further similarity between the two countries during the next 10 to 20 years when private ownership becomes well established in Estonia.

It seems that similar background characteristics segment forest owners in Estonia and Finland with regard to information needs. These include the size of the holding, the distance between the place of residence and the forest holding, and level of education. Gender is also significant in Finland, but not in Estonia. The results particularly from Estonia, but also from Finland, give reason to argue that occasionally approaching forest owners by mail (for example, once per year) may be a cost-effective way to both provide information and maintain interest in forestry issues among non-industrial private owners. Information about roundwood markets could be also provided via written or electronic media. Personal advice could be concentrated on complicated issues, such as economics and legislation. Other interactive methods, such as training courses, should be tailored and targeted at groups of forest owners according to their information needs.

This study has limitations typical for any survey. In particular, the Estonian data may not reflect all Estonian forest owners' attitudes completely, because the sample consisted of owners with larger than average estates, and with a higher than average general education. Therefore, strictly speaking, the results cannot be generalised to all Estonian forest owners. However, comparison of the results with reference studies give no reason to suspect that the results regarding ownership objectives and information needs are seriously biased indications, even if used as an approximation for all Estonian forest owners.

The results of this study cannot be generalised to other European countries, since Finland and Estonia cannot be considered as sufficiently representing private forest ownership in the whole EU-25. However, the study can be considered to provide useful indications of forest ownership objectives and information needs, which should be tested and analysed in detail in other countries. In further research, the linkages between the demographic characteristics of forest owners, ownership objectives and information needs deserve attention. This knowledge would help to tailor the information services so that the owners would meet their forestry-related objectives as well as possible, whether these are concentrated on wood production, landscape values, environmental protection or multiple forest uses. To facilitate the best possible comparability of results between countries, the questionnaires should be identical and the data collection should be carried out at about the same time, which was not the case in this research.

In terms of the need for a more comprehensive information base on small-scale forestry (noted by Hyttinen 2000), it can be concluded that regular follow-ups (such as once every five or 10 years) concerning private forestry would be useful in Europe. Allocation of resources and segmenting of forest owners presumes a sound knowledge about private forestry. Particularly in the new EU-member countries there is an overall need for in-depth analysis of private forest ownership. The follow-ups would also help to observe gradual changes in the private forest ownership structure, in forest owners' values and objectives, and whether these eventually lead to changes in the wood supply or to a stronger emphasis on non-economic values related to forest ownership.

## REFERENCES

Afifi, A.A. and Clark, W. (1990), *Computer-aided Multivariate Analysis*, 2nd edn, Lifetime Learning Publications, Van Nostrand Reinhold, Belmont.

Blum, A. and Schanz, H. (2002), 'From input-oriented subsidy schemes and beyond – theoretical implications of subsidy systems in forestry', in A. Ottitsch, I. Tikkannen and P. Riera (eds), *Financial Instruments of Forest Policy*, EFI Proceedings, No 42, Gummerus Printing, Saarijärvi.

Boyd, R. (1984), 'Government support of nonindustrial production: The case of private forests', *Southern Journal of Economics*, 5: 89–107.

Brazee, J.R. (2003), 'The Volvo Theorem: From myth to behaviour model', in F. Helles, N. Strange and L. Wichman (eds), *Recent Accomplishments in Applied Forest Economics Research*, Dordrecht, Forestry Sciences, 74: 39–48, Kluwer Academic Publishers.

Carlén, O. (1990), 'Private Nonindustrial Forest Owners' Management Behaviour. An Economic Analysis Based on Empirical Data', Rapport 92, Institutionen för Skogsekonomi, Sveriges Lantbruksuniversitet, Umeå, Sweden.

Cleaves, D.A. and Bennett, M. (1994), 'Holding size and behavior of nonindustrial private landowners: A cautious second look', in D.H. Newman and M.E. Aronow (eds), *Forest Economics on the Edge*, US Department of Agriculture, Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana.

Centre of Forest Protection and Silviculture (2001a), Estonian Forestry Development Programme, Draft 2.3, [www.metsad.ee](http://www.metsad.ee), last accessed 10 August 2001, (In Estonian).

Centre of Forest Protection and Silviculture and Ministry of the Environment of Estonia (2001b), 'The need for advising and the strategy for extension services in forestry', *Metsandusliku nõuande vajaduse analüüs ja metsandusliku nõuande strateegia väljatöötamine*, Final Report, Tartu, (In Estonian).

Dennis, D.F. (1989), 'An economic analysis of harvest behavior: integrating forest and ownership characteristics', *Forest Science*, 35(4): 1088–1104.

ECOSOC (European Economic and Social Committee) (2002), *Opinion on the Eastward Enlargement of the European Union and the Forestry Sector*, CES 523/2002, ISSN 1015-9487, Luxembourg.

FAO (2002), UNECE/FAO FORESTRY database (2002), <http://apps.fao.org/page/collections?subset=forestry>, last accessed March 2002.

Finnish Forest Research Institute (2004), *Finnish Statistical Yearbook of Forestry*, Agriculture, Forestry and Fishery, Vammalan Kirjapaino Oy, Vammala.

EU (European Union) (1998), *Forestry Strategy of the European Union*, Communication from the Commission 1998, COM(1998)649.

Grayson, A.J. (1993), *Private Forestry Policy in Western Europe*, Scottish Forestry Trust, UK, Short Run Press Ltd, Essex.

Greene, J.L. and Blatner, K.A. (1986), 'Identifying woodland owner characteristics associated with timber management', *Forest Science*, 32(1): 135–146.

Hair, J.R., Anderson, R.E., Tatham, R.L. and Black, W.C. (1995), *Multivariate Data Analysis with Readings*, 4<sup>th</sup> edn, Prentice Hall, Englewood Cliffs, New Jersey.

Hänninen, H. and Viitala, E.J. (1994), 'Metsänomistuksen rakennemuutos ja metsien käyttö, (Change in forest ownership structure and use of forests)', in Ovaskainen and Kuuluvainen (eds) 1994, *Yksityismetsänomistuksen rakennemuutos ja metsien käyttö* (Structural change in private forestry and the use of forests), The Finnish Forest Research Institute, Research Notes 484, Gummerus kirjapaino Oy, Jyväskylä, (In Finnish with English abstract).

Hänninen, H. and Uusipuro, J. (2002), 'Metsänomistajat neuvonnan ja metsäsuunnittelun käyttäjinä (Forest owners as users of forest management planning and extension)', Työtehoseuran metsätiedote 651 (Finnish Work Efficiency Association Forest Note 651), (In Finnish).

Hänninen, H., Karppinen, H., Ovaskainen, V. and Ripatti, P. (2001), 'Metsänomistajan uudistamiskäytätyminen (Forest owners' reforestation behaviour)', *Metsätieteen aikakauskirja* 4(2001): 615–629, (In Finnish).

Hyttinen, P. (2000), 'Policy aspects of small-scale forestry in Europe', in S.R. Harrison, J.L. Herbohn and K.F. Herbohn (eds), *Sustainable Small-Scale Forestry, Socio-economic Analysis and Policy*, University Press, Cambridge.

Hyttinen, P. (2004), 'Small-scale forestry: Perspectives around the world', in *Encyclopedia of Forest Sciences*, Elsevier Ltd.

Ihalainen, R. (1990), 'Rakennemuutokset yksityismetsänomistuksessa. Katsaus Suomessa 1960-89 tehtyihin tutkimuksiin, (Structural changes in Finnish non-industrial private forest ownership: A survey of the literature 1960-89)', *Folia Forestalia 750*, Finnish Forest Research Institute, (In Finnish with English summary).

Järvinen, E., Toivonen, R. and Kaimre, P. (2003), The Information and Training Needs of Private Forest Owners in Estonia, PTT Working Papers 61 (January 2003), Helsinki.

Järveläinen, V-P. and Torvelainen, J. (1993), 'Yhteiskunnan muutoksen vaikutus metsä- ja puutalouden tarjontatekijöihin, Summary: Impact of Social Change on Supply Factors in Finnish Forestry and the Forest Industry', Department of Economics and Management, University of Helsinki, Publications No. 2, Private Forestry, Helsinki, (In Finnish with English Summary).

Karppinen, H. (1996), *Private forestry in Estonia – results from a survey study conducted together with Indufor Oy*, Estonian Forestry Development Program (EFDP) Technical Report 4, June 1996, Tallinn.

Karppinen, H. (2000), 'Forest Values and the Objectives of Forest Ownership, Metsäntutkimuslaitoksen tiedonantoja 757', The Finnish Forest Research Institute, Research Papers 757, Helsinki.

Karppinen, H., Hänninen, H. and Ripatti, P. (2000), 'Changes in the Structure of Finnish Private Forest Ownership in the 1990s', in L. Hetemäki (ed.), *Finnish forest sector economic outlook 2000–2001*, The Finnish Forest Research Institute, Vantaa.

Karppinen, H., Hänninen, H. and Ripatti, P. (2002), 'Suomalainen metsänomistaja 2000 (Finnish forest owner 2000)', Finnish Forest Research Institute, Research Papers 852, Vantaa Research Centre, Gummerus Oy Jyväskylä, (In Finnish).

Kuuluvainen, J., Karppinen, H. and Ovaskainen, V. (1996), 'Testing the forest rotation model: Evidence from Panel data', *Forest Science*, 45: 539-551.

Kuuluvainen, J. and Ovaskainen, V. (1994), 'Yksityismetsän omistajien puunmyynteihin vaikuttavat tekijät' (Factors affecting wood sales from private forests), in V. Ovaskainen and J. Kuuluvainen (eds), *Yksityismetsänomistuksen rakennemuutos ja metsien käyttö* (Structural change in private forestry and the use of forests), The Finnish Forest Research Institute, Research Notes 484, Gummerus kirjapaino Oy, Jyväskylä, (In Finnish with English abstract).

Kuuluvainen, J., Ovaskainen, V., Karppinen, H. and Hänninen, H. (1995), 'Omistusrakenteen muutos ei uhkaa puuhuoltoa (Changing forest ownership structure is not challenging wood supply)', *Paper and Timber*, 4: 158-160, (In Finnish).

Leppänen, J., Pajuoja, H. and Toppinen, A. (2001), 'Effects of public support for forestry on timber supply', in B. Solberg, (ed.), *Scandinavian Forest Economics*, 37: 257-267.

Linden, M. and Leppänen, J. (2003), 'The impact of government investment assistance on forest investment and timber supply', in F. Helles, N. Strange and L. Wichman (eds), *Recent Accomplishments in Applied Forest Economics Research*, Forestry Sciences, 74, 167-179, Kluwer Academic Publishers, Dordrecht.

Lindroos, K. (2005), 'Metsänomistajien tavoitteet sekä tieto- ja neuvontatarpeet (Forest owners' objectives and information and training needs)', PTT Working Papers, No 76, Helsinki, (In Finnish with English abstract).

Marty, T.D., Kurtz, W.B. and Gramann, J.H. (1988), 'PNIF owner attitudes in the Mid-West. A case study in Missouri and Wisconsin', *Northern Journal of Applied Forestry*, 5(3): 194-197.

Mutanen, A. and Toppinen, A. (2004), 'Finnish sawlog market under forest taxation reform', *Silva Fennica*, 39(1): 1-14.

Ottitsch, A., Tikkanen, I. and Riera, P. (eds) (2002), 'Financial instruments of forest policy', EFI Proceedings No 42, Gummerus Printing, Saarijärvi.

Ovaskainen, V. and Kuuluvainen, J. (eds.) (1994), *Yksityismetsänomistuksen rakennemuutos ja metsien käyttö* (Structural change in private forestry and the use of forests), The Finnish

Forest Research Institute, Research Notes 484, Gummerus kirjapaino Oy, Jyväskylä, (In Finnish with English abstract).

Ripatti, P. (1996), 'Factors affecting partitioning of private forest holdings in Finland. A logit analysis', *Acta Forestalia Fennica*, 252: 1–84.

Ripatti, P. (1999), 'One Finnish family in six owns forest', in A. Reunala, I. Tikkanen and E. Åsvik (eds), *The Green Kingdom – Finland's Forest Cluster*, Otava Publishing Ltd, Metsämiesten Säätiö Foundation.

Rämö, A.-K., Tilli, T., Lindroos, K., Ruohola, H. and Ripatti, P. (2005), 'Metsäverojärjestelmän muutos ja yksityismetsäomistajien puun myyntiaikeet vuosina 2004-2007 (Forest taxation reform and forest owners' roundwood supply during the years 2004 to 2007)', PTT Reports No. 191, Helsinki, (In Finnish with an English summary).

Schraml, U. and Volz, K.-R. (eds) (2003), 'Urbane Waldbesitzer (Urban forest owners)', *Freiburger Schriften zur Forst- und Umweltpolitik*, Band I, Verlag Dr. Kessel, Remagen-Oberwinter, (In German).

Solberg, B. (2003), Ripatti, P. (1996), 'Factors affecting partitioning of private forest holdings in Finland. A logit analysis', *Acta Forestalia Fennica*, 252: 1–84, Policy developments affecting demand, supply and international trade of forest products: a European perspective', in L. Teeter *et al.* (eds), *Forest Policy for Private Forestry. Global and Regional Challenges*, CABI Publishing, UK.

Statistics Estonia /Statistical Office of Estonia (2001), *Database of Statistics*, [www.stat.ee](http://www.stat.ee), last accessed 5 September 2001.

Teeter, L., Cashore, B. and Zhang, D. (eds) (2003), *Forest Policy for Private Forestry. Global and Regional Challenges*, CABI Publishing, UK.

Tilli, T. and Skutin, S-G. (2004), 'Roundwood Markets in the Baltic Sea Region', Pellervo Economic Research Institute, Report No. 188, Helsinki.

Toivonen, R. and Mäki, P. (1999), 'Eastern Enlargement of European Union and forestry', PTT Working Papers No. 20, (May 1999), Helsinki, (In Finnish with English abstract).

Toppinen, A., Viitanen, J. and Toivonen, R. (2005), 'Dynamics of roundwood prices in Estonia, Finland and Lithuania', *Baltic Forestry*, 11(1): 88-96.

Ziegenspeck, S. (2002) 'Challenges for scientific working schemes in Germany concerning the evaluation of subsidies in forestry', in A. Ottitsch *et al.* (eds), *Financial Instruments of Forest Policy*, EFI Proceedings No 42, Gummerus Printing, Saarijärvi.